A I P S L E T T E R

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A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

Edited by
Eric W. Greisen
National Radio Astronomy Observatory
P.O. Box O, Socorro, NM 87801–0387
575–835–7236; Fax 575–835–7027
`daip@nrao.edu`
`http://www.aips.nrao.edu/`

General developments in *AIPS*

COVID-19

Sadly, the Covid-19 pandemic continues. The NRAO has returned to something like the "new normal." We are required to be fully vaccinated and to wear masks when in public spaces in NRAO facilities. We may remove the masks when in our offices with the door closed. Work from home is permitted and, perhaps, even encouraged. All of this has reduced the normal interactions between staff.

NRAO has purchased a Mac mini with the new ARM M1 chip for *AIPS*. Work has begun on the port to that architecture. This requires using a very modern version of gfortran (11.0.0), which turns out to treat some things as errors that really are not. With great care, *AIPS* code calls subroutines with variables that can be of integer or float type and can be scalars or arrays. Work on trying to satisfy the compiler is continuing. Note that the binary release of *AIPS* for Intel Macs works fine on ARM Macs and will continue to do so for several years.

The Covid status means that your editor would like to find additional, preferably interesting, things to do. If you find any problems with *AIPS* or have any suggestions for new or improved functions, please do not hesitate to e-mail me.

AIPSLetter publication

We have discontinued paper copies of the *AIPSLetter* entirely, at least for this issue. The *AIPSLetter* will be available in PostScript and pdf formats as always from the web site listed above. New issues will be announced in the NRAO eNews mailing and on the `bananas` and `mnj` list servers.

Current and future releases

We have formal *AIPS* releases on an annual basis. We recommend a full binary installation method for both the frozen and development versions for MacIntosh OS/X (Intel chips only), and Linux (32- and 64-bit) systems, but all architectures can do a full installation from the source files. There are no longer binary versions available for Solaris and Mac PPC chip architectures. If you develop *AIPS* code locally *or have system managers that forbid the use of* `rsync` or `cvs`, you will need to do a source-level installation. The current release is called `31DEC21` and is now "frozen." If you took a development copy of this version at some earlier date, you should use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only once in 2022 to convert your copy of 31DEC21 into the frozen version. However, when patches to 31DEC21 are announced in 2022, you may apply them with the MNJ. This *AIPSLetter* is intended to advise you of corrections and improvements in this release.

We have begun a new version, called 31DEC22, which is now under development by the *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having fetched 31DEC22, you may update your installation whenever you want by running the MNJ. This uses cvs, rsync, and/or transaction files to copy all changed text files and then to copy the binary files or to compile the code selectively based on the code changes and compilations we have done. We expect users to take their source-only or binary version of 31DEC22 *AIPS* over the Internet (via *anonymous* ftp). Both versions require you to copy the installation procedure install.pl via ftp; the source-only version also requires you to ftp the 175-Mbyte 31DEC22.tar.gz compressed tar file. Binary installations use only rsync, while locally compiled versions also use cvs. Linux sites will almost certainly have cvs installed; other sites may have installed it along with other GNU tools. Secondary MNJs will still be possible using ssh or rcp or NFS as with previous releases. We have found that cvs works very well, although it has one quirk. If a site modifies a file locally, but in an *AIPS*-standard directory, cvs will detect the modification and attempt to reconcile the local version with the NRAO-supplied version. This usually produces a file that will not compile or run as intended. Use a new name for the task or put a copy of the task and its help file in a private disk area instead.

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Installing a new version

If compiling locally, new releases must be installed from the tar ball for that release. 31DEC15 and later versions contain improvements to the code which should make local compilation more reliable. If using the binary installation, a full new installation must also be done with rsync. When installing a new *AIPS* release in a system that already has a previous release, we recommend that install.pl be used and that the previous release be left in place, at least until the new installation has been verified. If you do this, then you will not have to re-edit the disk, printer, and tape lists and can simply skip all those pages in the install.pl menus. The old $HOME/.AIPSRC file may be left in place, but it will need to be edited. The lines giving the DOWNLOADED and UNPACKED parameters should be cleared and the CCOMOPT line should be changed to point to the current release rather than the previous one. If you have made a special version of do_daily.*host*, you should preserve it under a new name and restore it after the install. If you have an odd set of *AIPS* versions, the $AIPS_ROOT/AIPSPATH.*SH files may need to be edited after the install to set the desired versions. The file $SYSLOCAL/UPDCONFIG also needs to be edited to correct your e-mail address(es).

31DEC09 contains a change in the format of antenna files. Previous releases will not understand the antenna coordinates for arrays that were traditionally left-handed (VLBI primarily). The format change occurs automatically when any 31DEC09 or later antenna-file specific code reads the file, after which older releases will have difficulties. 31DEC15 contains a change in the headers of *uv* data sets which will not be understood by previous versions. 31DEC20 contains a change to the XAS TV server which will cause problems with older versions. Note that the only version which we will patch for major errors is 31DEC21; even 31DEC20 will no longer be changed.

Improvements of interest to users in 31DEC21

In the latter half of 2021, new tasks appeared including CMPLX to perform complex mathematical operations on pairs of complex images, DT2PD to convert the new D-term text files to PD tables, MARSP to find the rotation measure affecting a planetary polarization image, PCABL to fill in cable cal values to a PCLOD-created PC table, PCDIV to change pulse-cal table amplitudes from TY or SY system temperatures, and VLBSY and VLBCD to create SY and CD tables from VLBA secondary text files. In the first six months of the year new tasks appeared including DGAUS to correct a model visibility file made with a Clean image for the Clean beam, IANTB to produce an ANTAB file from the GC and TY tables, VBRFI to compute statistics from autocorrelation data, PLRFI to make plots from the text file written by VBRFI, and SHAHO to flag holography data for shadowing. The new verbs are TVBANDW to perform several black-and-white enhancement schemes and TVDATA (also called TVFACTS) to remind the user of the parameters of the TV display. A pipeline RUN file, called VLBARFI, was developed to study RFI at the VLBA sites.

Normally, bugs which appear in an *AIPS* TST version and then are fixed in that same version before its release get little or no discussion in the *AIPSLetter*. Since a rather large number of sites now install the TST version of *AIPS* during its development, this is somewhat of an oversight. We urge you to run the "Midnight Job" at least once after 31DEC21 is frozen to bring it up to date and to fix all bugs of this sort. We urge active sites to use the MNJ and, when something odd occurs, to examine CHANGE.DOC using the cgi tool available from the *AIPS* documentation web page (http://www.aips.nrao.edu/aipsdoc.html). Please do not hesitate to contact us via the NRAO help desk (https://help.nrao.edu) or via e-mail daip@nrao.edu with any questions or suspicions that there are problems.

Imaging and Display

IMAGR was corrected to handle the situation where FLUX > 0 with no Clean boxes yet defined. This caused the task to stop Cleaning before it started when auto-boxing was requested, as in VLBARUN.

UVPLT was given the option to do time averaging prior to plotting the data.

Axis labeling was reviewed systematically to insure that the upper and lower level routines deciding on which ticks get plotted were doing it both correctly and with the same algorithms. Numerous corrections were made.

Contour plots will now display only those contour levels actually used. This change was made in a variety of secondary tasks and has now been made in the main tasks, KNTR, PCNTR, GREYS, and CNTR.

RGBLEVS will now be displayed by KNTR and PCNTR in normal fonts rather than the line-drawing fonts. The addition of an intensity for characters in the XAS display server made this change possible.

UV data

BPASS was corrected for a bad error in which the reference antenna could change part way through the spectrum due to channel-level flagging. The reference antenna is now chosen once for each solution. It now writes the calibration and BP version information to the history even for single-source files.

BPEDT was given the option to edit the BP table itself rather than just the *uv* data. Blanked channels may be given interpolated values on output. A SET TIME RANGE option was added as well, including to PCEDT.

TVFLG, SPFLG, and FTFLG had the sizes of their large buffers corrected. It is not clear how they were able to function previously. These tasks now warn the user when a pre-existing grid file is being used.

WIPER was given the complicated option to display the data on a baseline number axis (both 1-2 and 2-1 are displayed).

DOPOL application routines did not understand the codes from the PD table read routine. Accordingly, they would die when they should not when some but not all solutions are flagged.

PP tables are created by RLDIF and XYDIF in spectral mode, saving the phase correction spectrum. The format of the table was changed to include a column of the uncertainties. POSSM was changed to plot the PP data including the error bars and to forbid NPLOTS > 0 for such tables.

Index tables are now written by a number of tasks that could not do so previously.

VLBI matters

The VLB data reduction pipeline VLBARUN continued to get attention in the reporting period. This caused several changes to be made to the VLBAUTIL procedures. These are (1) VLBAAMP will skip the ACSCL step if there is no BP table and supports the ICHANSEL adverb used by ACSCL, (2) VLBALOAD to support the DOCONCAT adverb rather than forcing it to be true, and (3) VLBABPSS to support a new adverb BPASS5 to control the normalization of the data, setting BPASSPRM(5).

VLBARUN changes include

1. DOCONCAT is false when calling VLBALOAD
2. CHKNAME was replaced with NAMEGET which is more reliable and one place that assumed INSEQ was 1 was corrected.
3. The TEC section now deletes the /tmp/jpl* data file it read.
4. Corrected DOPLOT = 2 mode to plot the correct CL and SN tables and to report the correct plot file numbers at the end. The RFLAG plot files are now also reported.
5. Added a procedure to set the correct Stokes; VPLOT does not accept 'HALF' when there is only 1 polarization.
6. Changed to delete any pre-existing message output file.
7. Changed to display the output of LISTR 'SCAN' mode after the INPUTS in the message output file.
8. Changed the UVPLT section to display 3 plots: channel averaged data time smoothed, fully time and channel averaged data versus baseline length, and no averaging versus baseline length.
9. Changed auto-boxing in IMAGR to take only one box per major cycle.
10. Added BPASS5 to allow control of BPASSPRM(5).
11. Corrected handling of CALSOUR(2) = '*'.
12. Corrected the usage of the procedure that finds the main input file name.
13. Fixed the loop running RFLAG to prevent an infinite loop.
14. Dropped the use of the TV to set the colors for the RFLAG plots.
15. An option to use CALIB rather than FRING in the time-dependent calibration and/or the self-cal was added.

VLBARFI had the meaning of DOPLOT changed to allow better selection of plots and to allow DOBAND < 0 to omit BPASS. It was then modified to support a generic calling procedure by finding CALSOUR and TIMERANG where possible. Changes like those listed above were also made. A script named VLBAWIDE was written to invoke VLBARFI on a set of input data sets such as could be observed to cover much of the VLBA's available frequencies.

Four new tasks were written to enable testing of VLBA matters, particularly the issue of fluxes from RDBE 2. PCABL copies the cable cal values from the small PC table shipped with the data to the large PC table created by PCLOD from a secondary text file. VLBSY reads a VLBA total power text file to create an EVLA-like SY table while VLBCD reads a VLBA cal text file to extract the noise tube values into an EVLA-like CD table. These two tables are widely understood in *AIPS*. PCDIV copies a PC table multiplying or dividing by the system temperature found from a TY pr SY table.

VBGLU was changed to allow the second data set to have been observed on a completely different day. It can then be used to join two data sets with different frequencies so long as they have the same number of spectral channels in each spectral window and the same number of spectral windows ("IFs" in *AIPS*-speak). IMAGR cannot handle two independent input files, so, at the cost of wasted disk space, this option allows an image to be made from two or more data sets.

BASRM is designed to fit a polynomial baseline to autocorrelation data and remove it. The task was substantially rewritten and now does what it is supposed to do.

VLA and Analysis

CMPLX is a new task to perform addition, multiplication, and division on two "complex" images where a complex image is actually two images either real and imaginary or amplitude and phase.

DT2PD is a new task to convert a D-term text file to a standard spectral polarization D-term (`PD`) table. This is the first of a number of tasks to implement absolute D-term calibration of VLA data.

ELINT was changed to allow data from all IFs to be included in a single fit, to plot multiple IFs in a single plot, to scale the fits to 1.0 at a specified elevation, and to improve the displays of the fits and the coloring of the plots. Updating a `CL` table is now only an option.

HOLOG now can use `CELLSIZE` to set the image cell size, avoiding the standard, frequency-dependent cell sizes.

PBEAM now can plot the smooth model with data samples and the residuals versus radius, avoiding the foibles of the gridding process. Changed to read multiple groups of data, allowing the construction of spectral cubes. Additional annotation including which contour levels were used was added to the plots. Fitting of power data (moving antenna with moving antenna) was corrected and the option to fit in power was added.

PANEL was given a new plot type to show which panel corner is which over the entire antenna surface. The theoretical gain displayed was corrected.

MARSP is a new task which compares the polarization angles around an image of a planet to measure how far off they are from radial. In other words, to determine what rotation measure affected the data.

BDF2AIPS was given the `DOALL` option to allow writing of the pointing (`PT`) table. These tables are now written every 0.1 seconds and so are grossly large and of no use to *AIPS*. Therefore, the default is to omit these tables.

General

Input lines to `AIPS` may now be 128 characters in length, up from the classical 80.

DELAY now takes an optional immediate argument for the time delay.

STALIN now limits the deleted history records to those matching `PRTASK`.

Documentation was updated systematically, including the *CookBook*, `ABOUT` files, the `TAB`-completion file, and numerous adverb help files. Verbs `EXTLIST` and `PLGET` were changed for changes in plot tasks.

FREESPAC had its format changed to allow for even larger disk areas such as on NRAO's Lustre systems.

Patch Distribution for 31DEC20

Because of the extensive use of binary installations, we now patch the master copy of the most recently frozen version. Older versions are not corrected even for egregious errors. Thus, 31DEC20 was patched during 2021 and 31DEC21 will be patched as needed during 2022. Your copy of them may be corrected simply by running a Midnight Job. Information about patches and the code may be found using links from the main *AIPS* web page or by *anonymous* ftp to the NRAO server ftp.aoc.nrao.edu. Documentation about patches to a release is placed on this site at pub/software/aips/*release-name* and the code is placed in suitable sub-directories below this. Patches to older releases are kept here as well, but they will require local compilation.

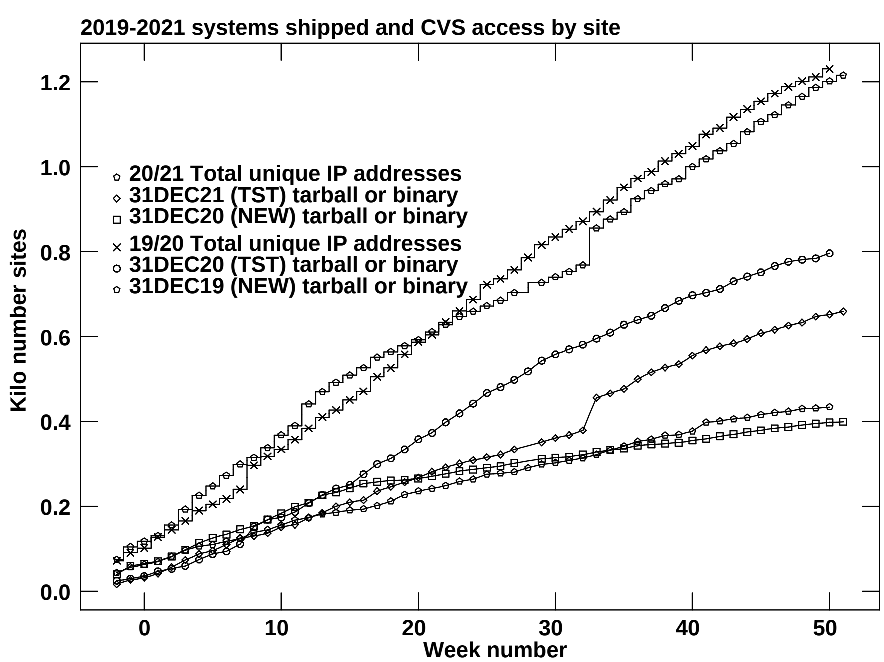
The 31DEC20 release is no longer available for installation and will no longer receive patches even for egregious errors. It had a number of important patches during 2021. They are

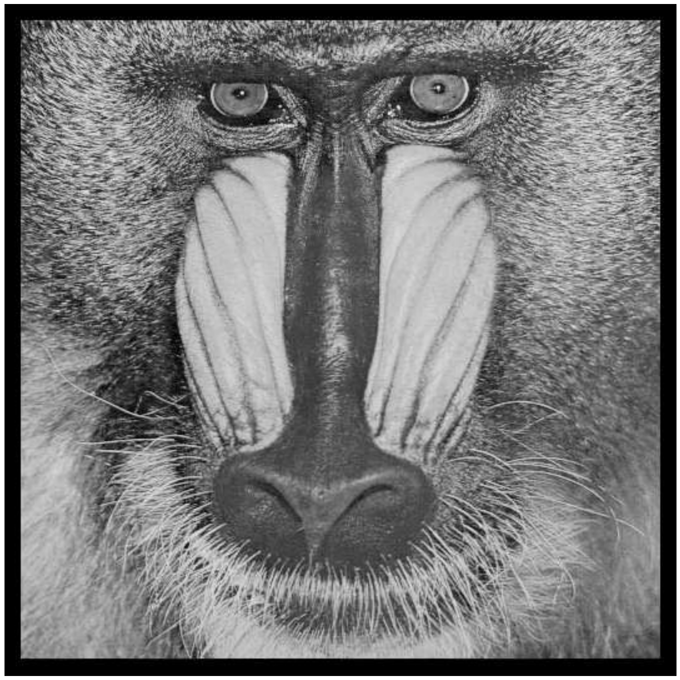
1. SPLIT and CLIP would always say that it is not calibrating anything despite the adverbs. *2021-01-20*
2. SPRMS had a slight error in labeling frequency and the Y axis. *2021-02-23*
3. CLIP generated a false error message. *2021-04-14*
4. VLBARUN needed to reset IMSIZE after UVPLT calls; also allow PostScript out when convert does not work. *2021-04-22*
5. UVPLT could decide to plot phases from 0 to 360 ignoring any user-specified range. *2021-04-27*
6. LISTR listed single-source velocities incorrectly. *2021-04-27*
7. BPASS could change reference antenna in the middle of a spectrum. *2021-07-16*
8. TVFLG, SPFLG, FTFLG did not define enough memory. *2021-07-26*
9. IMAGR could quit at the start when a flux limit was specified with auto boxing *2021-10-22*

𝒜ℐ𝒫𝒮 Distribution

From the NRAO system logs, we count apparent MNJ accesses, downloads of the tar balls, and `rsync` accesses by unique IP address. Since DSL and some university and other connections may be assigned different IP addresses at different times, this will be a bit of an over-estimate of actual sites. However, a single IP address is often used to provide 𝒜ℐ𝒫𝒮 to a number of computers, so these numbers are at the same time an under-estimate of the number of computers running current versions of 𝒜ℐ𝒫𝒮. In 2021, a total of 399 different IP addresses downloaded the frozen form of `31DEC20` and 659 IP addresses downloaded `31DEC21` in tarball or binary form. With the change to the MNJ (rsync only) we are unable even to guess how many sites have run the MNJ. The total number of unique IP addresses in these five lists was 1215. The plot of numbers versus time and the table shows that 2021 was substantially behind 2020.

year	`TST` name	`NEW` name	`TST`	`NEW`	`TST` binary	`NEW` binary	Total unique
2004	31DEC04	31DEC03	808	196			1276
2005	31DEC05	31DEC04	832	246	299	48	1460
2006	31DEC06	31DEC05	806	191	402	94	1398
2007	31DEC07	31DEC06	965	277	669	161	1811
2008	31DEC08	31DEC07	1058	246	986	303	2107
2009	31DEC09	31DEC08	1228	307	1082	478	2399
2010	31DEC10	31DEC09	1228	307	1203	477	2416
2011	31DEC11	31DEC10	1105	270	1064	424	2228
2012	31DEC12	31DEC11	940	284	1028	396	1698
2013	31DEC13	31DEC12	1014	307	990	443	1937
2014	31DEC14	31DEC13	1045	333	848	431	1843
2015	31DEC15	31DEC14	1104	309	1001	350	1817
2016	31DEC16	31DEC15	878	222	788	372	1330
2017	31DEC17	31DEC16	874	408	768	386	1383
2018	31DEC18	31DEC17	684	368	603	343	1099
2019	31DEC19	31DEC18	754	406	686	388	1155
2020	31DEC20	31DEC19	796	434	750	470	1230
2021	31DEC21	31DEC20	659	399	604	376	1215





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AIPSLETTER
National Radio Astronomy Observatory
Post Office Box O
Socorro, NM 87801-0387
USA